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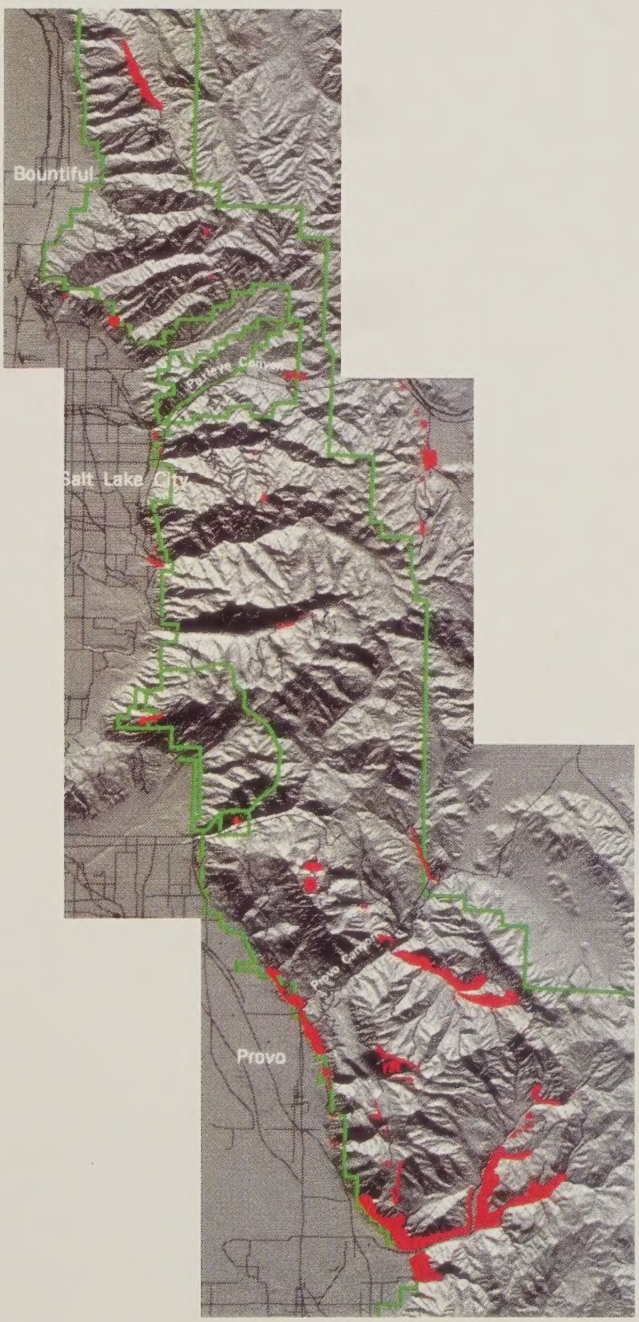
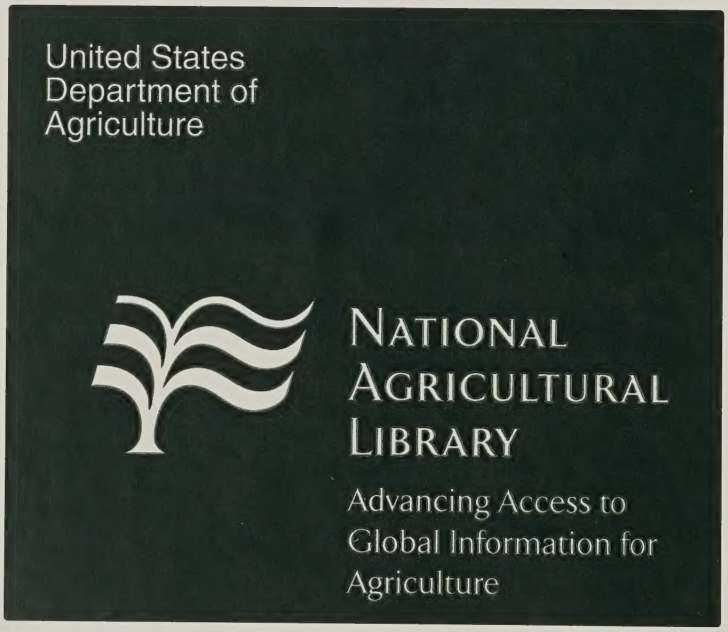
Survey Summary for Threatened, Endangered, Sensitive and Locally Rare Species of Lepidoptera

Utah Gypsy Moth Eradication Program: 1989-1993



Acknowledgments

We thank Valerie DeBlander and Dawn Hansen for digitizing and creating the GIS maps used in this report. Much thanks goes to those that helped protect the enclosed mentioned lepidoptera during the eradication project; Brian Gardner, Alan Dymerski, Valerie DeBlander, Dawn Hansen, Steve Munson, John Guyon and Robert Kehrer. For editorial comments we would like to thank Dawn Hansen, Valerie DeBlander, Steve Munson and Leon LaMadeleine.



Survey Summary for Threatened, Endangered, Sensitive and Locally Rare Species of Lepidoptera

Utah Gypsy Moth Eradication Program: 1989-1993

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Abstract

Surveys and monitoring of non-target lepidoptera were essential in the success of the Utah gypsy moth eradication projects. Surveys for threatened, endangered, sensitive and locally rare lepidoptera species were started early in the project. Maps of non-target lepidoptera locations were made and overlaid with treatment areas. Where conflicts existed between treatment with *Bacillus thuringiensis* var. *kurstaki* and non-target lepidoptera a variety of mitigative measures were employed. The exclusion of sensitive areas from treatment was used extensively during the Utah eradication project. Other mitigative measures included: removing fertilized females for eggs and rearing larvae that would be reintroduced; removal of eggs and/or larvae for later reintroduction and no precautionary steps taken and rely on natural reintroduction from adjacent populations. Monitoring was done during and after treatment to determine any impacts to non-target lepidoptera.

Introduction

Gypsy moth, *Lymantria dispar* L., originally introduced in Massachusetts in 1869, has continued to spread throughout the United States. Generally infested states now include New Jersey, Pennsylvania, Maryland, North Carolina, West Virginia, Virginia, Ohio, Michigan and all of the New England states. Suppression and eradication efforts using a variety of treatments have been conducted by local, state and federal agencies since 1890 (Kirkland 1905, Burgess 1930). Since the early to mid 1970's, eradication or suppression tactics have increasingly emphasized the use of biological insecticides. The most commonly used biological insecticide is *Bacillus thuringiensis* var. *kurstaki* (Btk), which acts as a lepidoptera larvacide. Btk has little or no direct impact on a broad range of terrestrial and aquatic organisms which increases its utility in gypsy moth suppression and eradication programs. However, limited data exists on the affects of Btk on non-target insect species, particularly those found in the order Lepidoptera (Peacock 1990, Miller 1988, Brower 1986, Forsberg 1976). There are indications that Btk formulas specifically developed for gypsy moth control may act indiscriminately on various species of lepidoptera from several families (Whaley 1991, Brower 1986, Miller 1988, Forsberg 1976). If this is correct, populations of non-target lepidoptera species may be impacted negatively following treatment programs where Btk is used to control populations of gypsy moth. When lepidoptera populations known to have clumped or patchy distributions are exposed to successive treatments of Btk, local extinctions may occur (Schweitzer 1989, Forsberg 1976). This is particularly important for species whose phenology is in synchrony with that of the gypsy moth. Because negative impacts may occur within some lepidoptera communities, Lepidoptera societies and other professional groups are concerned about Btk applications.

In July 1988, a gypsy moth infestation (North American strain) was discovered in the Olympus Cove area southeast of Salt Lake City, Utah. Because of potential negative economic and environmental impacts if gypsy moth became established in Utah, a delimiting survey was immediately implemented to determine the size and distribution of the gypsy moth population. A multi-agency Gypsy Moth Decision and Action Committee was formed to address this introduction. The committee developed an eradication strategy using an integrated pest management (IPM) approach.

The IPM plan included the following strategies:

1. Quarantine - This area included sites where various life stages of the gypsy moth were found and the potential for human assisted dispersal via RV's, vehicles, outdoor furniture etc, was significant. A request was made to homeowners and businesses within quarantine areas to complete an inspection certificate as they surveyed for various life stages of this insect. Quarantine areas were adjusted annually based on delimitation surveys.
2. Detection Trapping - A trapping grid was implemented state-wide using APHIS protocols to detect introduced gypsy moths. Trapping intensity varies throughout the state depending on susceptible host type and urban environments.
3. Delimitation Trapping - This trap array is confined to sites where populations of gypsy moth are established or are suspected to occur. Trap densities are higher than the general detection survey. Trapping density depends on terrain and susceptible host type. The data collected from the delimitation survey is used to define the infested area and determine treatment boundaries.
4. Treatment - Aerial and ground treatments consisted of three applications of Btk at 5-7 day intervals. Btk applications were conducted in the spring when early instar gypsy moth larvae were present.
5. Environmental Assessment (EA) - An EA, with annual supplements, was completed to address public concern and potential impacts of the IPM strategy.
6. Non-Target Impacts - To address treatment effects on other species of lepidoptera, a non-target lepidoptera survey and monitoring program was developed.

There are a variety of lepidopteran habitats and a wide diversity of lepidoptera fauna, because of elevational changes along the Wasatch Range, in Northern Utah. Per equal area of habitat, there are more diurnal butterflies in the Intermountain West than in any habitat found east of the Mississippi River. Because of its mountainous terrain and habitat diversity, Utah ranks third in North America relative to the number of butterfly species found within state borders (Scott 1986).

In Utah, as in other western states, the distribution of a lepidoptera species is limited to specific geographic locations. Often within these locations, they occur only at scattered sites because butterfly species do not survive equally within all micro-habitats and climates.

Because of the expected impact on non-target lepidoptera from Btk treatments, butterfly and moth monitoring surveys were implemented. All populations of threatened, endangered, sensitive (TES) and locally rare (LR) species within treatment areas were surveyed to document any adverse impacts during the gypsy moth eradication program (Whaley 1989, 1991a, 1991b, 1993, and 1994).

The objectives of this non-target survey were:

1) To determine the presence of native Utah TES or LR lepidoptera species within treatment areas.
2) To determine if susceptible life stages of TES and LR species coincide with the pesticide application period.
3) To develop and recommend mitigation measures for species vulnerable to Btk applications.
4) To assess the effectiveness of mitigative measures.

Methods

Butterfly Surveys

Before surveys were initiated in 1989, a Utah Lepidopterists Society Gypsy Moth Committee was formed to determine which species of butterflies and moths (those fitting the TES or LR categories) occurred or may occur in the eradication area. An initial list of 17 species was compiled by the Committee. This original list eventually increased to 20 species over a four year period (Appendix A & B). In 1989, a letter was drafted by the Committee and sent to the editor of "News of the Lepidopterists' Society", soliciting assistance from Lepidopterists residing in other states/countries. Before and during the butterfly surveys, Utah State University, University of Utah and Brigham Young University museum collections were reviewed to determine availability of information on species distribution within the survey area. Lepidopterists known for their extensive collecting experience in northern Utah were also consulted for lepidoptera distribution data, information on habitats and specific host plants for larvae.

To meet the non-target objectives stated above, intensive lepidoptera surveys were conducted in areas that could be treated during the eradication program (Figures 2 & 3). The potential treatment area included roughly 540 square miles along the Wasatch Range in northern Utah. The objective of these surveys was to identify new colonies of TES and LR species within survey boundaries. During the surveys, several spot checks were conducted on sites where suitable habitat existed for a particular species. Where appropriate, specimens were collected and placed in glassine envelopes. At least one specimen was collected from each new colony. To assist in the survey, the Brigham Young University herbarium was used to locate preferred hosts of TES and LR larvae within the project area.

Surveys began in late March continuing through August. Timing the survey was important to ensure adequately covering flight periodicity of all TES and LR species presumed to occur in the project area. Using field collections and museum data, butterfly distributions were plotted on United States Geological Survey (USGS) 7.5 minute series topographic maps (Figure 1). Completed maps were used to develop mitigative techniques to reduce impacts on non-target lepidoptera.

Moth Surveys

In 1991, a moth survey was conducted to determine if any sensitive species were within or near treatment areas. Duplicating the approach used for butterfly surveys, museum and private collections from local lepidopterists were reviewed for information on sensitive species that occurred in the area. Light trap surveys were used to search for colonies of sensitive species. This tactic only proved effective for assessing smaller (microlepidoptera) species and was not used in 1992.

Moths were collected in 1992 using techniques called tapping and sugaring. During daylight hours when certain species of moths were resting, trees on selected sites were tapped using a wooden pole to dislodge the resting adult moths. They were then collected with nets. The sugaring technique employed an alcoholic-sugar-fruit solution spread on tree trunks. This baiting strategy attracted species that normally feed at night on tree sap or other fermenting plant juices. Both methods are frequently used by moth collectors to collect species of Noctuids, like the genus Catocala. Sensitive moth species locations were marked on United States Geological Survey (USGS) 7.5 minute topographic maps.

Butterfly & Moth Mapping

Butterfly and moth location data was transferred to ARC-INFO, a geographic information system (GIS), (Figures 2-8). For this report the lepidoptera survey area was divided into 5 sections; northern, north central, central, south central and southern (Figure 2). The sections overlap slightly so populations on section borders were not lost. A three dimensional perspective for each section was developed using an elevation data layer. This 3-dimensional perspective helped to determine terrain features (ridge, canyon bottom, or slope) and aspects associated with each colony. Color codes were assigned to each species and used consistently between sections.

The GIS lepidoptera survey overlay was placed over gypsy moth treatment blocks to determine if colonies of moths/butterflies would be affected by the treatment. Mitigative measures were initiated if colonies within or adjacent to treatment blocks were at risk. Various strategies used separately or in combination were employed to protect non-target butterflies and moths. These strategies listed in order of preference are:

1) Colonies at risk were not treated by creating exclusion areas (no spray zones) large enough to minimize the effect of drift. This option was employed if conflicts arose between treatment and protecting colonies of non-targets. This was the easiest mitigative strategy to employ and was used extensively during the eradication program. To maximize aircraft safety and minimize drift, a five acre section was selected as the minimum exclusion area. Most of the sites selected as exclusion areas had little to no gypsy moth host material present. Exclusion areas were marked with fluorescent panels and balloons to easily distinguish them from treatment areas. All exclusion areas with susceptible host type for gypsy moth were mass trapped at a rate of nine traps per acre. Mass trapping was used to determine if gypsy moth populations were present and to serve as a suppression tactic if populations were found within the exclusion area.

2) Removing fertilized females for egg deposition in the lab and rearing the larvae in captivity. If gypsy moth populations were no longer detected in an area and no further treatment was anticipated, non-target species were then reintroduced.

3) Removing eggs and/or larvae from a colony and rearing them in captivity for later reintroductions.

4) Applying Btk with no precautions taken to avoid known colonies of sensitive and/or LR species. A monitoring program was initiated to document the effect of treatment on non-targets. If a colony is significantly affected, losses greater than 50 percent, gravid females were collected from nearby colonies and reintroduced to the site. If nearby untreated colonies were large and adjacent to the affected colony, natural recolonization could occur following treatment. The rate of recolonization is species specific, and dependent on many factors including; weather conditions during dispersal periods, terrain, host plant availability, just to name a few. The disadvantage associated with this tactic was the potential affect on the gene pool when reintroductions were made with individuals from another colony.

Monitoring non-target species within spray blocks was conducted annually during the adult dispersal period for the affected species. Adult lepidoptera were counted within monitored sites using 50 minute walking transects through species habitat. Monitoring was conducted in treated and untreated areas to compare population densities and determine impact of Btk treatments.

Mass trapping (nine traps/acre), was used in exclusion areas where no treatment occurred and gypsy moth host material was present. The mass trapping technique was used as a detection tool for exclusion areas and to disrupt male moth mating.

The Forest Service Cramer, Barry, Grim (FSCBG) Model was used to minimize off site movement (drift) of Btk into exclusion or sensitive areas (Teske et al, 1993). The model produces drift scenarios associated with weather, terrain, formulation and method of application. If information exists on toxicity of Btk to specific lepidoptera (lethal threshold) the model will provide information on minimizing lethal rates of drift and the ability to assess impacts associated with drift off target.

Results & Discussion

Although no threatened or endangered lepidopteran species were found within the eradication project area, species categorized as sensitive or locally rare were found on some sites. The Forest Service defines a sensitive species as; those plant and animal species for which population viability is a concern, such that 1) significant, current or predicted downward trend in population numbers or density and/or 2) significant, current or predicted downward trend in habitat capability could reduce existing distribution of a species. It is possible that a reduction in number or distribution of a population can occur for species found only in small isolated colonies. These colonies represent a disjunct range extension of a particular species that may be adversely affected by multiple applications of a biological insecticide. Disjunct populations of species with low vagility or recolonization potential could be significantly impacted. The lepidoptera species that fall into these categories in the general gypsy moth eradication area are listed in Appendix A. Appendix B is the species account and survey status which also references species location in figures 3-8.

The survey methodology used to locate, determine extent and size of non-target lepidoptera worked very effectively. Overlaying non-target survey maps over treatment areas highlighted sites where conflicts would occur. During five years of aerial and ground treatment with Btk, five sites were identified where sensitive or locally rare butterfly species were within treatment boundaries. There were seven other sites where non-target populations were down canyon. Drift studies conducted during application operations indicated that drift down canyon could affect these non-target colonies.

Sensitive populations within a treatment block were marked and excluded from treatment. This approach of reducing or eliminating non-target exposure to Btk had various degrees of success. Success varied according to the size, shape and location of exclusion areas. Generally, the larger the area the effect of Btk on non-targets in the center of the exclusion area was reduced or absent. Square areas experienced less drift than polygon-shaped exclusion areas. Large square areas were easier to mark, and thus locate, for application pilots. Exclusion areas visited by application pilots before treatment, experienced less drift. Each approach described previously reduced or eliminated drift into exclusion areas. Exclusion areas in steeper terrain, steeper than a 60 percent slope, were harder to exclude from the effects of drift. Establishing Btk tolerance of a particular species would also help to reduce Btk impacts on non-targets. Previous studies indicate some species of lepidoptera are more tolerant to Btk exposure (Peacock and Schweitzer, 1993).

Mass trapping within an exclusion area with known gypsy moth populations were not an effective strategy for eradication. Canyon winds and the ability of gypsy moth larvae to balloon, allowed gypsy moth populations to disperse beyond the mass trapping zone. To determine how effective a mass trapping strategy is, it takes two years to note if traps decreased gypsy moth populations. If mass trapping is not effective, the population continues to increase and spread. Initially male gypsy moths are expected to be caught in mass traps. However, a second year of data is required to determine if populations were actually reduced based on male moth captures. In 1991 an exclusion area, with gypsy moth host material, was not treated and mass trapped. That year five moths were caught within the exclusion area. The following year 58 moths were caught, which resulted in having to treat 1726 acres. Although difficult to substantiate, we felt this additional treatment was a result of not treating the 10 acre exclusion site 2 years previous. If gypsy moths are in fact sympatric with sensitive or LR species, other treatment measures besides mass trapping may be employed (ie. pheromone flakes or gypsy moth virus).

Most of the moths captured were cryptic species, difficult to see because their coloring blended so well with the tree's surface. Tapping usually worked well during the heat of the day, because many species migrate toward the tree's base to escape the heat. The tapping procedure worked particularly well for *Catocala*. Only two moth species were found within the treatment area and considered sensitive or locally rare, *Catocala briseis* and *C. ophelia*.

There was only one species that was monitored multiple years and records kept. Table 1 compares the number of *Incisalia fotis* recorded between treatment and exclusion plots from 1991 to 1994. Aerial treatments with Btk were conducted in June 1990 and 1993. A decline in *I. fotis* counts was observed following both applications in the treatment block and within the exclusion area. However, there was a difference in the numbers of adults between the treated and exclusion areas. Table 1 shows a steady increase in adults for both treated and exclusion areas for 4 consecutive years following treatment, illustrating recovery to normal population levels. The exclusion plot appeared to serve the purpose of facilitating the dispersal from the exclusion plot into the application site, increasing population recovery.

Date of Transect	Number of Fotis Recorded in Treatment Block	Number of Fotis Recorded in Exclusion Area
April 5, 1991	1	13
March 29, 1992	3	26
April 4, 1992	4	34
April 11, 1992	12	23
April 17, 1993	28	64
April 22, 1994	69	80
March 31,1994	64	119
Total	181	359

Conclusions

To protect non-target lepidoptera species a combination of mitigative measures should be undertaken. As a first step, an extensive lepidoptera survey of the area of concern needs to be developed and implemented. Threshold impacts to the insecticide being used should be determined if possible. Then, the FSCBG model can be used to develop potential buffer zones as related to possible drift under different spray conditions. From the FSCBG outputs and threshold impact data, exclusion boundaries can be established and marked prior to treatment. The exclusion area should be no smaller than 5 acres if rotary-wing aircraft are used and no smaller than 10 acres if fixed-wing aircraft are used. There are many variables that can influence the size of an exclusion area, but generally, the larger the buffer the better for the non-target species of concern. With smaller exclusion areas, reintroduction measures should be considered. Gravid females, eggs, and/or larvae can be removed, reared and reintroduced after no further treatment is anticipated. These measures can be very difficult to implement, because females of some species cannot be found, or the colonies and size of the larvae are so small that finding samples to collect are very tedious and in some cases impossible.

Monitoring is also a key in protecting non-target species. A monitoring plan should be developed and implemented in all areas where protection of non-target species is taking place.

Appendix A

Sensitive and/or locally rare lepidoptera species within the gypsy moth eradication area, Northern Utah.

1. *Nathalis iole* (Dainty Sulfur)
2. *Incisalia fotis* (Early Elfin)
3. *Lycaena cupreus* (Lustrous Copper)
4. *Lycaena editha* (Edith's Copper)
5. *Callophrys sheridani* (White-lined Green Hairstreak)
6. *Euphilotes spaldingi* (Utah Summer Blue)
7. *Satyrium saepium* (Hedgerow Hairstreak)
8. *Satyrium fuliginosum* (Sooty Hairstreak)
9. *Satyrium californicum* (California Hairstreak)
10. *Danaus gilippus* (Queen)
11. *Cyllopsis pertepida dorothea* (Arroyo Satyr)
12. *Neominois ridingsii* (Ridings Satyr)
13. *Precis coenia* (Buckeye)
14. *Thessalia leanira alma* (Paintbrush Checkerspot)
15. *Speyeria hydaspe sukuntala* (Lavender Fritillary)
16. *Speyeria n. nokomis* (Great Basin Silverspot Fritillary)
17. *Boloria selene* (Silver Meadow Fritillary)
18. *Catocala briseis* (Briseis Underwing Moth)
19. *Catocala ophelia* (Ophelia Underwing Moth)
20. *Callophrys spinetorum* (Blue Mistletoe Hairstreak)

Appendix B

Species Account and Survey Status

1. *Nathalis iole* (Dainty Sulfur) - The closest regularly occurring breeding colony to the eradication project is near Utah Lake State Park. The larval food plant is Bur-Marigold, *Bidens cernua*, (Compositae). This species breeds regularly in the southern counties of Utah, but this is the only breeding colony known in the northern part of the state.
   CATEGORY: Locally Rare

2. *Incisalia fotis* (Early Elfin) - This is a habitat restricted butterfly tied to the distribution of the larval food plant Cliff-rose, *Purshia mexicana* (Rosaceae). It flies in March and April and is in the larval stage in May and early June. This species is found in Utah County (Figures 7 & 8).
   CATEGORY: Sensitive

3. *Lycaena cupreus* (Lustrous Copper) - Occurs in isolated colonies at lower elevations in the Wasatch Range on the east slopes north of Park City in areas where its larval food plant Alpine Sorrel, *Rumex paucifolius* (Polygonaceae) is found (Figures 5 & 7).
   CATEGORY: Sensitive

4. *Lycaena editha* (Edith's Copper) - This butterfly is found in extremely isolated colonies with few species per colony. Only three small colonies in the eradication area are known (Figures 3, 5 & 6). It is associated with its larval food plant, Sheep Sorrel, *Rumex acetosella*, (Polygonaceae). Edith's Copper flies from late June to August and overwinters in the egg stage. Eggs hatch and larvae feed in the spring.
   CATEGORY: Sensitive

5. *Callophrys sheridani* (White-lined Green Hairstreak) - This butterfly occurs in very isolated colonies where its larval food plant, Shortstem Buckwheat, *Eriogonum brevicaule*, (Polygonaceas), is found. There is an early flight season population (late March to mid April) along the lower foothills (5,000 to 6,000 ft.), and a late flight population common in July at higher elevations, including ridge lines, in the Wasatch Range. Larvae found at lower elevations would be feeding from April through May (Figures 4, 5, 6 & 7).
   CATEGORY: Sensitive

6. *Euphilotes spaldingi* (Utah Summer Blue) - This species is found in isolated colonies and is quite rare. It occurs only where its larval food plant Redroot Buckwheat, *Eriogonum racemosum*, (Polygonaceae) is found (Figures 5 & 6).
   CATEGORY: Locally Rare

7. *Satyrium saepium* (Hedgerow Hairstreak) - This species is found in isolated colonies on relatively low foothills and ridges (Figures 4, 6 & 8). In this region, larval food plants are Deer Brush, *Ceanothus velutinus* and Alder-leaf Mountain Mahogany, *Cercocarpus montanus*, (both Rasaceae).
   CATEGORY: Locally Rare

8. *Satyrium fuliginosum* (Sooty Hairstreak) - This is a butterfly of medium to high elevations (7,500 to 10,000 ft) with colonies usually consisting of very few individuals. Its larval food plant is Silvery Lupine, *Lupinus argenteus*, (Leguminocae). The species overwinters in the egg stage, larvae feed in the spring and adults are flying from July to early August (Figures 4, 5, 6 & 8).
   CATEGORY: Locally Rare

9. *Satyrium californica* (California Hairstreak) - This is a rare species and is very colonial. Apparently there are few colonies in northern Utah. Larval food plants are Alder-leaf Mountain Mahogany, Deer Brush, Chokecherry, *Prunus virginiana*, Serviceberry, *Amelanchier alnifolia* and possibly Bitterbrush, *Purshia tridentata*, (all Rosaceae). The species flies from mid July to August and over-winters in the egg stage. Larval would be present during treatment for gypsy moth (Figures 4 & 8).
   CATEGORY: Locally Rare

10. *Danaus gilippus* (Queen) - The nearest breeding colony for this species is in wet areas near Provo Industrial Park, South Provo. It migrates northward into the eradication area and reproduces. The arrival time of first migrants, depending upon weather conditions, would be mid-June to mid-July. Its larvae feed on several species of Milkweed.
    CATEGORY: Locally Rare

11. *Cyllopsis pertepida dorothea* (Arroyo Satyr) - The nearest viable breeding colony along the northern Wasatch Range is found near the mouth of Spanish Fork Canyon (Figure 8). The Arroyo Satyr normally flies around mid-June and again in August. Larvae feed on various species of grass and hibernate during the winter. They emerge in the spring and begin feeding on fresh grass growth.
CATEGORY: Locally Rare

12. *Neominois ridingsii* (Ridings Satyr) - Prior to 1989 the only known breeding colony in the Wasatch Range was a small one discovered along the grassy slopes and lower ridges above Maple Canyon east of Mapleton, Utah County. This survey documented that the colony extended well beyond the original boundary in Utah County (Figures 5, 7 & 8). In Salt Lake County the only colony was found near the mouth of Lambs Canyon. The larvae overwinter and emerge in the spring to feed on grasses. Bluebunch Wheatgrass, *Elymus spicatus* along the Wasatch Range is the preferred host for this species.
CATEGORY: Sensitive

13. *Precis coenia* (Buckeye) - This species may be present in the eradication project area. It was collected once in Rock Canyon located in Utah County. The principle population is found in Washington County located in the southern portion of Utah.
CATEGORY: Locally Rare

14. *Thessalia leanira alma* (Paintbrush Checkerspot) - This species is found along the Wasatch Range in and near Provo Canyon and on the foothills overlooking Edgemont and Orem, in Utah County (Figures 4 & 5). Its larval food plant is Common Paintbrush, *Castilleja chroma*, (Scrophulariaceae) which grows on open rocky and grassy slopes between oak and juniper. This species overwinters in the larval stage and emerges in the spring.
CATEGORY: Sensitive

15. *Speyeria hydaspe sukuntala* (Lavender Fritillary) - Prior to these surveys, the closest colony to the project area was found on Bountiful Peak. This disjunct colony was considered a range extension south into Davis County. As a result of this survey a specimen was collected at the top of City Creek Canyon in Salt Lake County. This is further south than the colony recorded on Bountiful Peak (Figure 4). This species overwinters in the larval stage and emerges in the spring. Larval host plants include: Violet, *Viola nuttallii*, Blue Violet, *Viola adunca*, and Pine Violet, *Viola purpurea*, (all Violaceae).
CATEGORY: Sensitive

16. *Speyeria n. nokomis* (Great Basin Silverspot Fritillary) - This is a Utah candidate species (Category 2) for federal listing (explain what candidate species, category 2 and federal listing means, the reader may not know). It inhabits wet meadows and isolated seeps, usually in lower valley floors or dry desert areas where the larval food plant, Bog Violet, *Viola nephrophylla* is found. It is not known to occur in the Wasatch Range. Like many fritillary butterflies, this species overwinters in the larval stage and emerges in the spring. As with all spring feeding larvae, they could be susceptible to spring, early summer insecticide applications.
CATEGORY: Sensitive

17. *Boloria selene* (Silver Meadow Fritillary) - The only known breeding colony in Utah County is in wet meadows and sloughs along the east side of Utah Lake (Figure 7). Its larval host plant is *S. nokomis*. This species also overwinters in the larval stage.
CATEGORY: Sensitive

18. *Catocala briseis* (Briseis Underwing Moth) - The only recorded finds for this species are in Deer Creek and a few other locations in northern Utah (Figures 6 & 7). The natural range of this species is north of Utah, this species is rarely found in Utah.

19. *Catocala opelia* (Ophelia Underwing Moth) - This species is found in the southwestern United States. However, isolated single specimens are occasionally found in the Wasatch Range of northern Utah. This species is also considered rare if found in northern Utah (Figures 6 & 7).

20. *Callophrys spinetorum* (Blue Mistletoe Hairstreak) - This species was not previously recorded along the Wasatch Range until a collector observed adults specimens in Bowman Fork which is located in Mill Creek Canyon (Figure 5). This species is associated with Douglas-fir mistletoe, *Arceuthobium douglasii*.
CATEGORY: Locally Rare

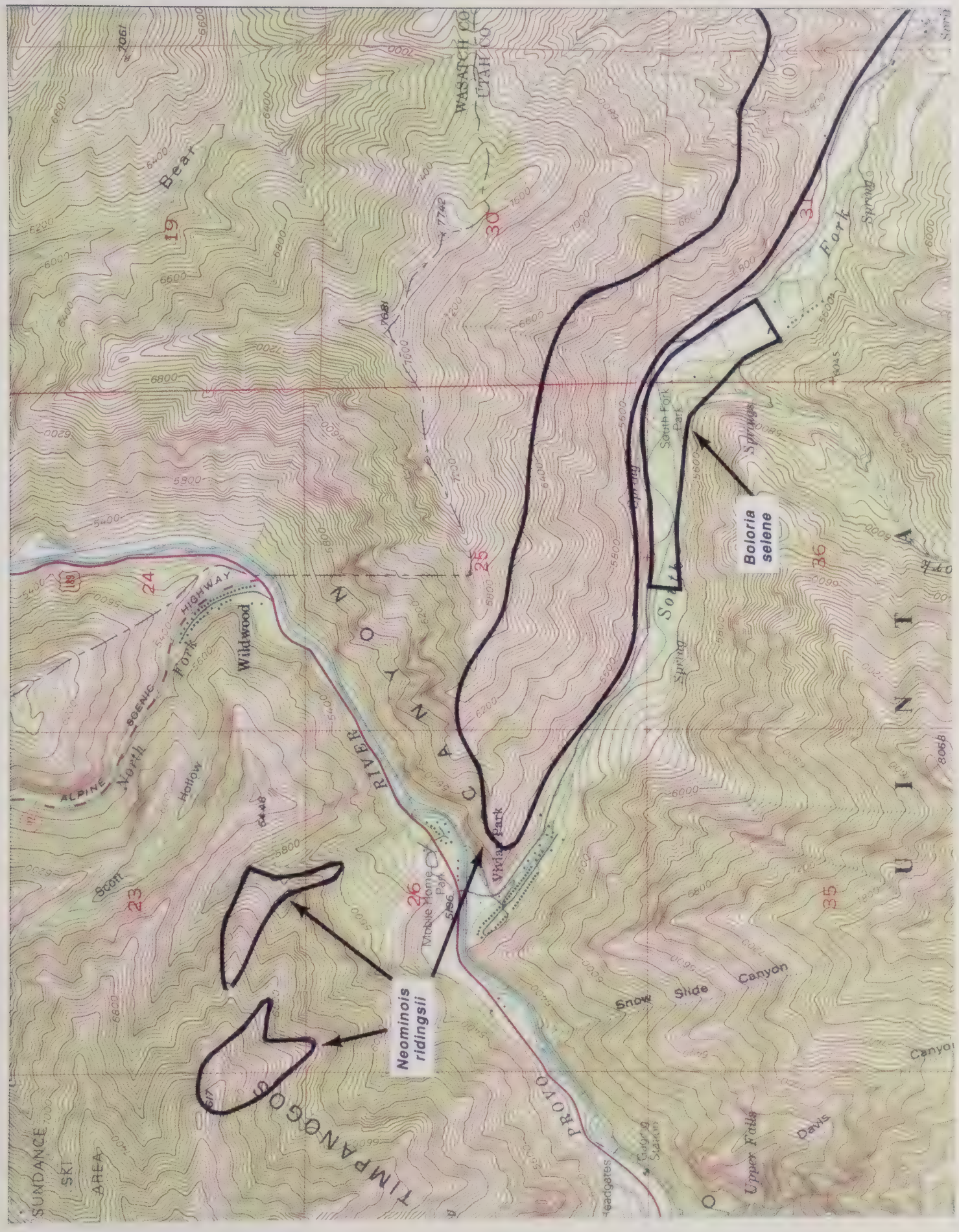


Figure 1. 1:24,000 scale topographic map showing boundaries and names of lepidoptera collected during ground surveys.

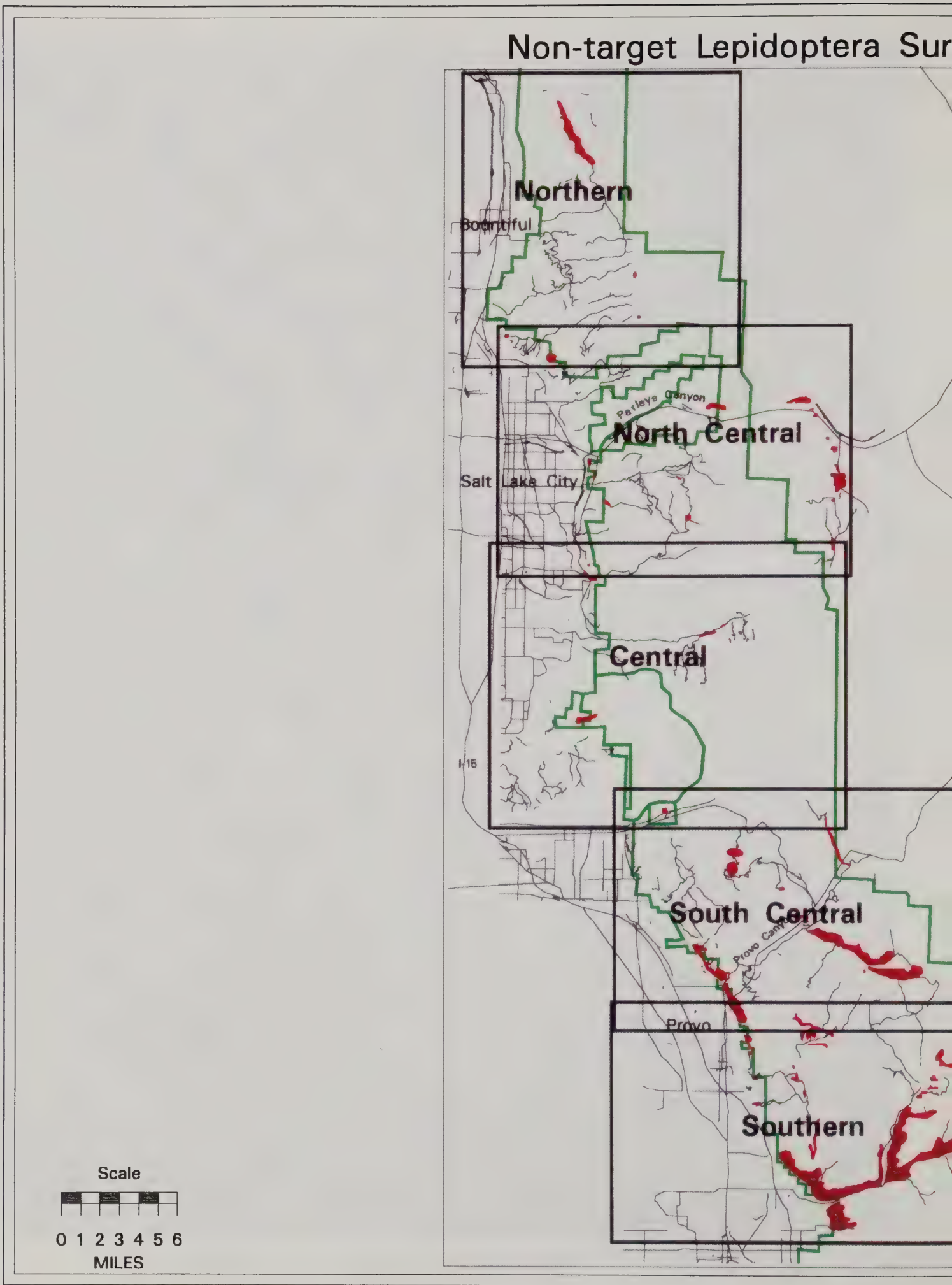
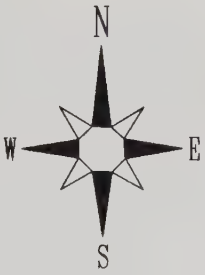


Figure 2. Lepidoptera survey area showing the five zones that are view in Figures 4-8.



Wasatch Front
Utah

Lepidoptera species

Roads

NFS Lands

General Area

Prepared by John Anhold, Valerie DeBlander
and Dawn Hansen
Forest Pest Management, Ogden UT
July 1994

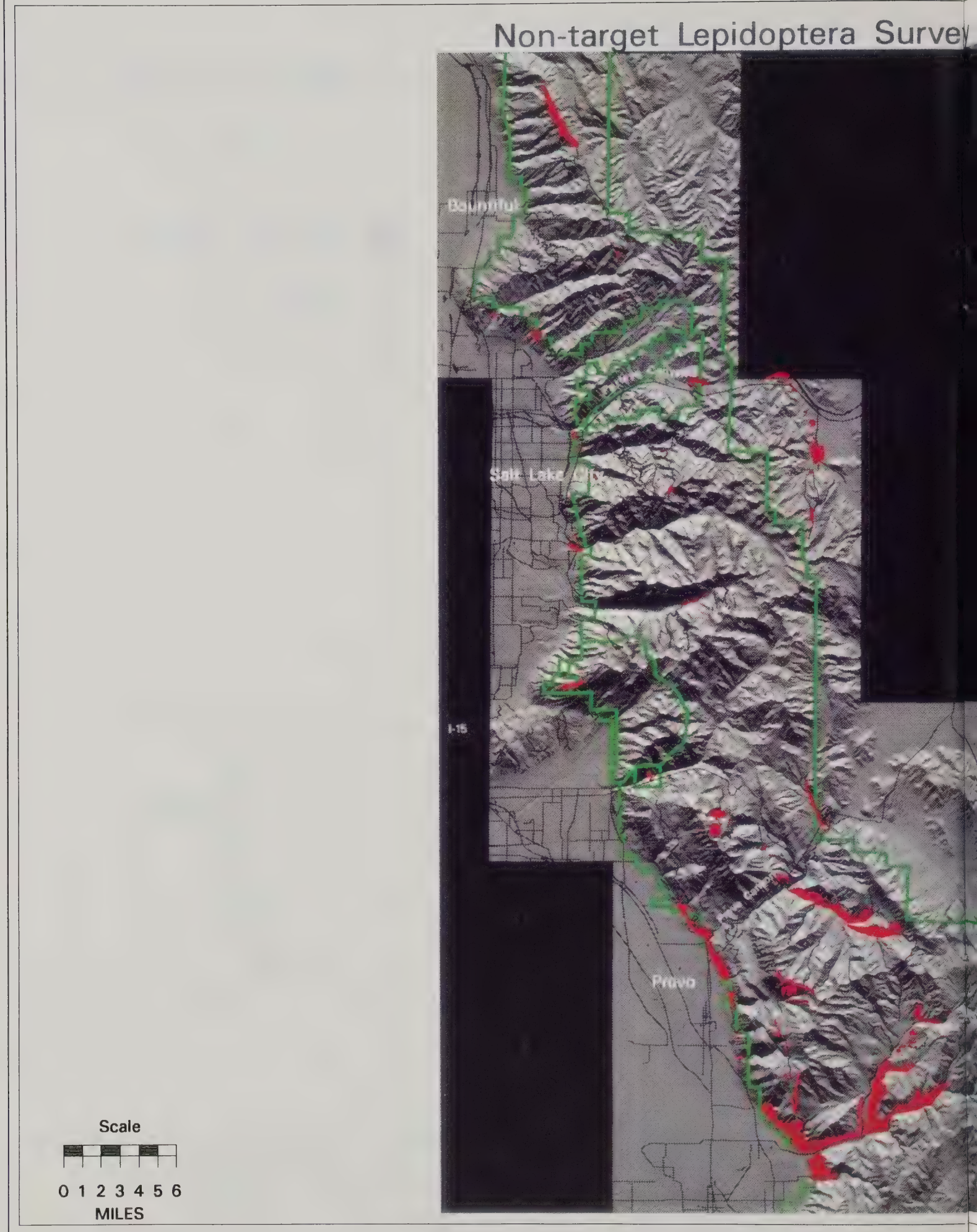
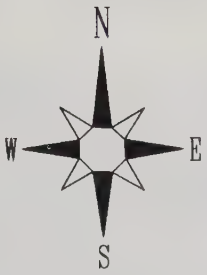


Figure 3. Lepidoptera survey area with elevational data overlayed to give a 3-dimensional appearance.



Wasatch Front
Utah

Lepidoptera species

Roads

NFS Lands

General Area

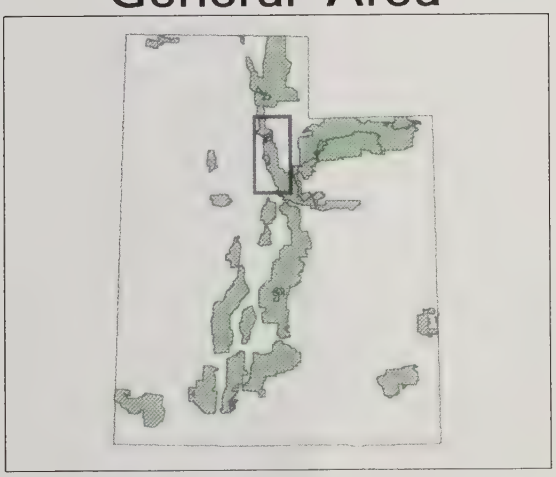


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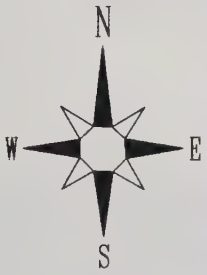
Figure 4. Close-up of Northern survey area with locations of non-target lepidoptera.

pulations

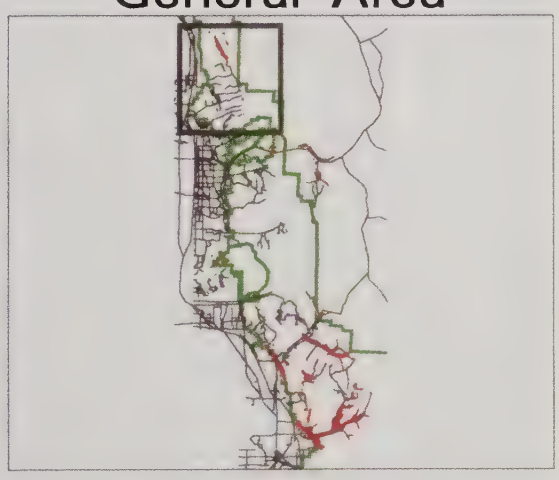


Wasatch Front Utah

- *Callophrys sheridanii*
- *Lycaena editha*
- *Satyrium fuliginosum*
- *Speyeria hydaspe sukuntala*
- *Thessalia leanira alma*
- *Callophrys sheridanii*
  Speyeria hydaspe sukuntala
- *Satyrium fuliginosum*
  Satyrium saepium
  Satyrium californicum

- Roads
- NFS Lands

General Area



Scale

0 1 2 3 4 5

MILES

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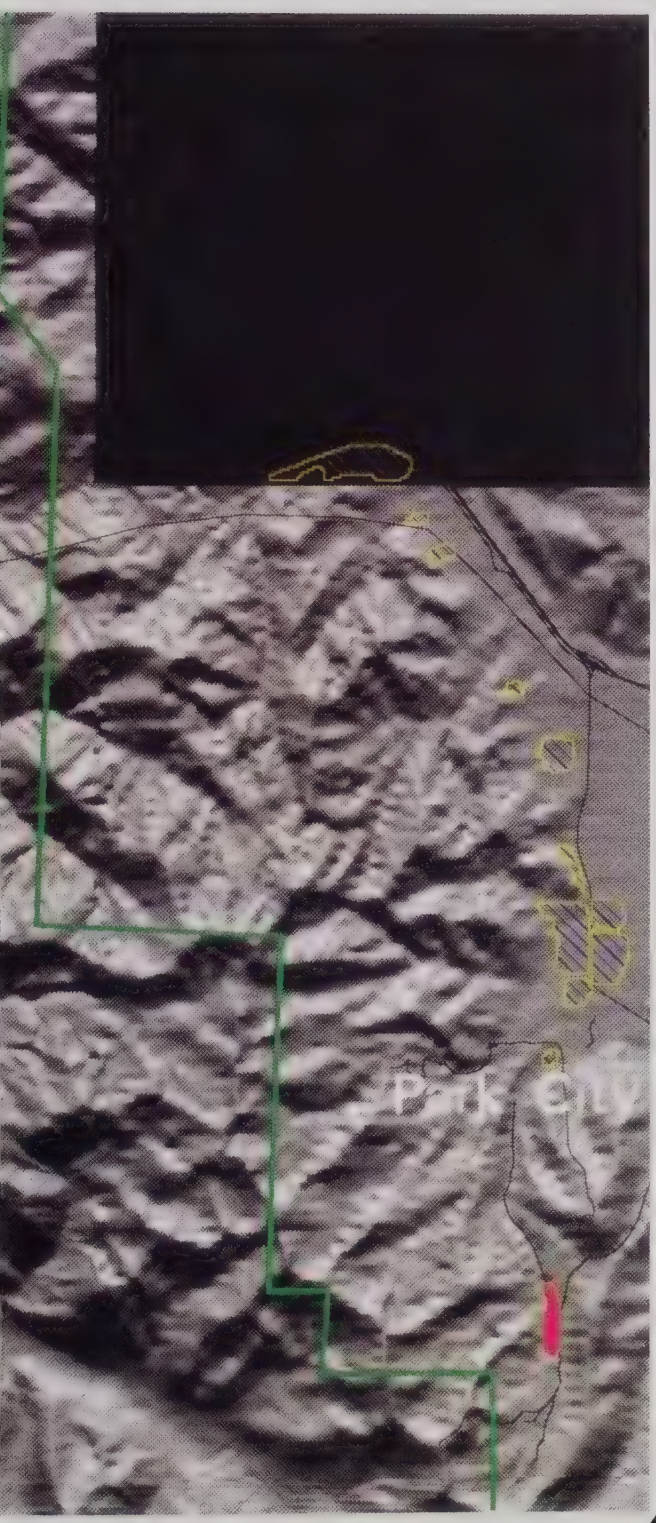
Figure 5. Close-up of North Central survey area with locations of non-target lepidoptera.

pulations



Wasatch Front
Utah

- *Callophrys sheridanii*
- *Callophrys spinetorum*
- *Euphilotes spaldingi*
- *Lycaena editha*
- *Neominois ridingsii*
- *Satyrium fuliginosum*
- *Thessalia leanira alma*
- *Lycaena cupreus*
  Lycaena editha
- Roads
- NFS Lands

General Area

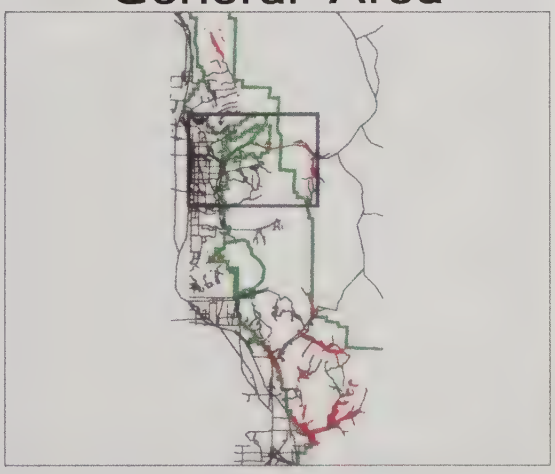


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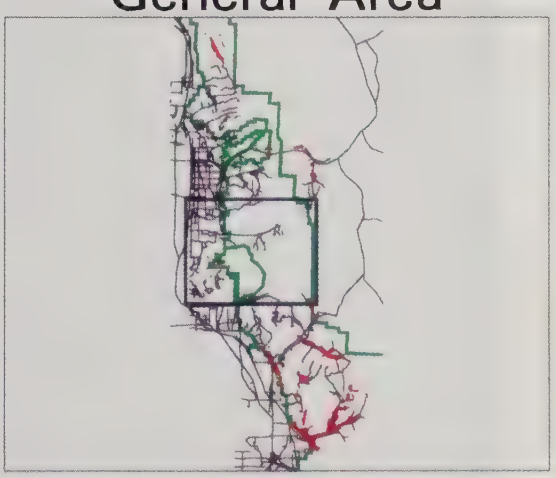
Figure 6. Close-up of Central survey area with locations of non-target lepidoptera.

pulations

Wasatch Front Utah

- *Catocala briseis*
- *Catocala ophelia*
- *Euphilotes spaldingi*
- *Lycaena editha*
- *Satyrium saepium*
  Satyrium fuliginosum
- Roads
- NFS Lands

General Area



Scale

0 1 2 3 4 5

MILES

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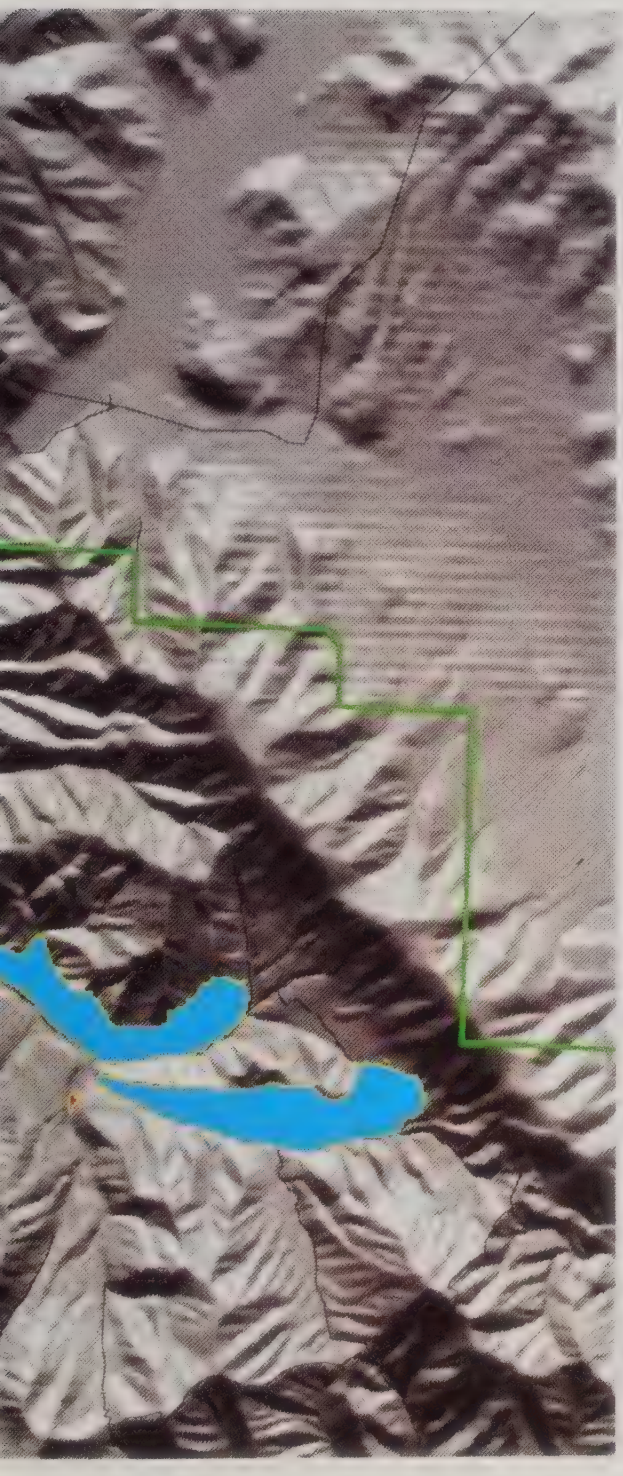
Figure 7. Close-up of South Central survey area with locations of non-target lepidoptera.

pulations



Wasatch Front Utah

- *Boloria selene*
- *Callophrys sheridanii*
- *Catocala briseis*
- *Catocala ophelia*
- *Incisalia fotis*
- *Lycaena cupreus*
- *Lycaena editha*
- *Neominois ridingsii*
- *Callophrys sheridanii*
  Incisalia fotis
- Roads
- NFS Lands

General Area

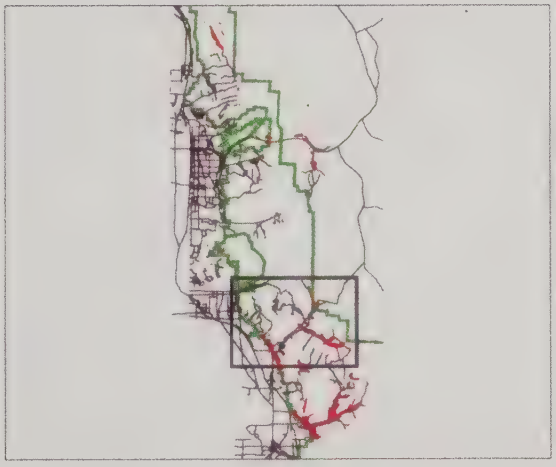


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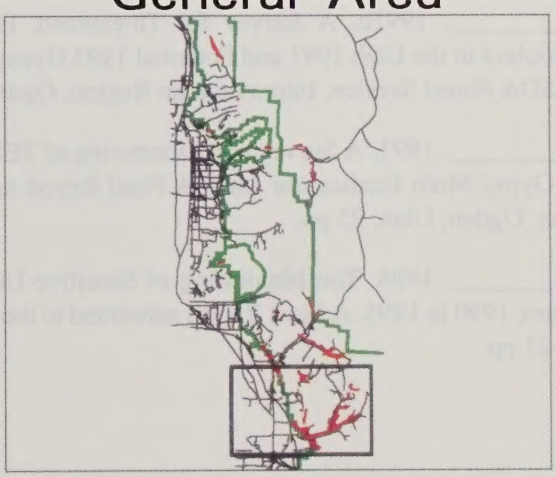
Figure 8. Close-up of Southern survey area with locations of non-target lepidoptera.

pulations

Wasatch Front Utah

- *Callophrys sheridanii*
- *Cyllopsis pertepida dorothea*
- *Incisalia fotis*
- *Lycaena editha*
- *Neominois ridingsii*
- *Satyrium californicum*
- *Satyrium fuliginosum*
- *Satyrium saepium*
- *Thessalia leanira alma*
- *Neominois ridingsii*
  Satyrium fuliginosum
- *Neominois ridingsii*
  Satyrium fuliginosum
  Satyrium saepium
- *Satyrium fuliginosum*
  Satyrium saepium
- Roads
- NFS Lands

General Area



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